

*Catalogue of Real Paths of Large Meteors.*  
By Professor Gustav von Niessl.

(Communicated by W. F. Denning.)

The following real paths of large meteors have been computed by me in recent years.

The descriptions of the objects were partly collected by myself, partly taken from various scientific papers and journals, viz. from Heis's *Wochenschrift für Astronomie*, *Reports of Vienna Academy*, the *Comptes Rendus* of the French Academy, the *American Journal of Science*, and others.

The succession of the several phenomena contained in this list is arranged according to the month and day (beginning with the commencement of the year), without regard to the particular years in which they were observed, as in my opinion this method of tabulation will allow a ready and convenient means of reference.

I have not availed myself of the very numerous and valuable notices and researches in the reports of the Luminous Meteor Committee of the British Association for the Advancement of Science (1848 to 1880), as one may hope that a summary of them will be prepared by Professor Herschel.

It is also to be hoped that a general catalogue of the real paths of fireballs will soon be compiled, and that this will include the results of other workers in this field; for example, Galle, Weiss, Newton, Koerber, &c.

*Brünn, Austria :*  
1896 November 12.

Jan. 1897.

## Real Paths of Large Meteors.

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## List of Paths of Large Meteors &amp;c., Computed by Professor G. von Niessl.

(Communicated by W. F. Denning.)

Ref. No.	Date of Appearance.	Time, G.M.T. and (Local Time).	Locality.	Apparent Size or Magnitude.	Real Height. When First Seen.	Length to the Earth Last Observed (Geo- Path, centric).	Radiant Point.	Number of Observations Used.	Remarks, References, &c.	
1	Jan. 12 (1879)	6 <sup>h</sup> 26 <sup>m</sup> (7 23)	Austria	= C *	41	10	124	17	133 + 19° δ	*Thus: like Moon. Detonating.
2	12 (1879)	6 33 (7 30)	Austria	Large fireball	87	18	124	13	52 - 10°	6 Detonating.
3	16 (1895)	10 49 (11 49)	Austria	$\frac{1}{2}$ C	118	31	124	49	196 + 56°	5 Velocity not accurate.
4	16 (1895)	10 50 (11 50)	Austria	C	35	31	166	47	172.5 - 23°	24 Detonating.
5	16 (1895)	10 52 (11 54)	Austria, Germany	C	96	21	177	19	341.1 + 56.4	26 Detonating.
6	17 (1890)	3 42 (4 40)	Austria	Brilliant	88	51	265	...	109 + 23.5 2	2 Detonating.
7	17 (1890)	4 6 (5 9)	Austria- Hungary	$\frac{1}{2}$ C - C	97	25	353	34	113.6 + 21.7	24 Detonating.
8	23 (1876)	4 44 (5 49)	Austria- Hungary	$\frac{1}{3}$ C	64	16	128	16	17 - 20	5
9	25 (1895)	6 51 (7 53)	Austria	About = C	97	31	83	23	104 + 30	27 Detonating.

Ref. No.	Date of Appearance.	Time, G.M.T. (Local Time).	Locality.	Apparent Size or Magnitude.	Height. When First Seen.	Length of Path. (Geo- centric). English Miles.	Real Velocity to the Earth (Geo- centric). a. °	Radiant Point. a. °	Number of Observations Used.	Remarks, References, &c.	
10	28 (1870)	5 <sup>h</sup> 3 <sup>m</sup> (5 58)	Germany	3 × ♀	51	31	64	...	19° 5 - 20°	2	See accounts in Heis's <i>Wochenschrift für Astronomie</i> , 1870.
11	Feb. 3 (1856)	7 55 (8 20)	Switzerland, France	Very large	138	43	248	62	120 - 7	3	See Heis's investigations in Jahn, <i>Unterhaltungen</i> , T. x.
12	3 (1882)	2 7 (3 45)	Hungary	Very large	115	5	297	...	264 + 40	4	The Mocs Meteorites. Detonating.
13	10 (1875)	5 51 (6 0)	France	Of a singular magnitude	119	...	...	...	53 + 50	4	Only radiant well determinable. <i>Comptes Rendus</i> , T. lxxx.
14	12 (1875)	15 45 (10 30)	United States	More than ☽	37	25	115	11	104 - 30	9	The Marengo (Amana) Meteorites. See Leonard's account in <i>American Journal of Science and Arts</i> , Ser. 3, Vol. x. Detonating.
15	15 (1865)	5 29 (6 0)	Germany	⌚	115	28	193	24	279 + 60	4	See accounts in Heis's <i>Wochenschrift</i> , 1865.
16	20 (1870)	9 33 (10 5)	Italy	Bright meteor	46	23	69	23	273 + 62	2	See accounts in Heis's <i>Wochenschrift</i> , 1870.
17	24 (1871)	9 9 (10 14)	Austria	♀	90	33	87	44	210 + 55	2 (by Meteoroscopes)	
18	Mar. 4 (1872)	9 29 (10 1)	Italy	⌚	62	36	37	37	115 + 83	3	

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Ref. No.	Date of Appearance.	Time, G.M.T. and (Local Time).	Locality.	Apparent Size or Magnitude.	Height When First Seen.	Height When Last Observed (Geo- centric).	Length to the Earth (Geo- centric).	Radiant Point.	Number of Observations Used.	Remarks, References, &c.
19	9 (1822)	15 <sup>h</sup> 0 <sup>m</sup> (10 0)	United States	⊖	41	29	76	40° 257° +40°	Many	See Dean's accounts in <i>Gürtel's Annalen</i> , T. lxxv, and <i>Poggendorf</i> , T. ii. Detonating.
20	13 (1883)	6 <sup>h</sup> 22 <sup>m</sup> (7 21)	Austria	Large fireball	102	24	117	39° 149° - 9°	8	
21	17 (1871)	10 <sup>h</sup> 40 <sup>m</sup> (10 49)	France	Large	115	...	more than 550	15° 345° +50°	8	See accounts in <i>Comptes Rendus</i> , T. lxxii.
22	21 (1877)	5 <sup>h</sup> 59 <sup>m</sup> (7 4)	Austria, Italy	> ♀	184	18	600	15° 55° - 9°	4	Scarcely accurate.
23	25 (1873)	7 <sup>h</sup> 30 <sup>m</sup> (8 20)	Denmark	½ ⊖	80	23	60	24° 175° +55°	4	See accounts in Heis's <i>Wochenschrift</i> , T. 1873.
24	Apr. 2 (1852)	6 <sup>h</sup> 25 <sup>m</sup> (6 30)	France	Splendid meteor	10	9	83	12° 215° +17°	2	See Delitz's investigations in <i>Comptes Rendus</i> , T. xxxv.
25	2 (1891)	7 <sup>h</sup> 50 <sup>m</sup> (8 57)	Austria	½ ⊖ - ⊖	109	17	180	24° 29° +55° 2	28	Detonating.
26	9 (1876)	7 <sup>h</sup> 15 <sup>m</sup> (8 38)	Austria-Hungary	⊖	101	20	197	26° 17° +57°	7	Detonating.
27	10 (1874)	7 <sup>h</sup> 4 <sup>m</sup> (8 4)	Austria	2 × ⊖	48	18	56°	14° 19° +57°	6	Detonating.
28	11 (1869)	10 <sup>h</sup> 3 <sup>m</sup> (10 35)	Italy	Bright meteor	96	57	40°	... 207° +49°	2	

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				English	Miles.	α δ	α δ		
29	II (1871)	9 m (9 46)	Italy	Bright meteor	... 25	...	216 -10	3	Detonating.
30	21 (1887)	8 o (8 58)	Austria	C	82	23	214 -13	15	
31	22 (1871)	10 5 (10 37)	Italy	Bright meteor	... 43	...	231 -7	2	Radiant, not accurate, but probably not identical with the former of Apr. 21.
32	22 (1888)	6 52 (7 55)	Austria	$\frac{3}{4}$ C	116	23	186 100.7 + 10.1	41	
33	29 (1877)	8 37 (10 17)	Sweden	C	42	19	73 14.5 ± 0	4	See Sundell's account in <i>Finska Vetenskaps Societ. Förhandl. T. xxvii.</i>
34	May 5 (1869)	6 2 (6 32)	Germany	Large	30	5	48 19.9 + 8	3	The meteorite of Krähenberg. See Neumayer in Vienna <i>Acad. T. lx.</i> Detonating.
35	14 (1864)	8 o (8 o)	France	C	174	14	418 86.5 + 24.0	11	The meteorites of Orgueil.
36	20 (1869)	16 17 (11 25)	United States	Very large	53	28	45 210 - 18	3	See Loomis's accounts in <i>Amer. Jour. Ser. II. Vol. xlviii.</i> Detonating.
37	26 (1751)	4 56 (6 o)	Austria-Hungary	C	118	28	280 60 + 20.5	2	Ironfall at Hradischin. De- tonating.
38	28 (1880)	7 26 (8 39)	Austria-Hungary	C	51	27	74 100 + 35	2	

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39	June 2 (1886)	9 m (11 o)	Austria	> 4	...	25	...	...	Not accurate,
40	3 (1842)	8 51 (9 o)	France	⊖	130	11	165	30	272 + 46.5
41	3 (1883)	8 44 (9 50)	Austria	Splendid meteor	124	21	332	22	249.9 - 20.2
42	3 (1883)	10 39 (10 57)	North Sea	⊖	188	23	454	23	248 - 20
43	7 (1858)	9 29 (10 o)	Germany	Brilliant meteor	85	18	115	53	256 + 2
44	8 (1888)	17 24 (18 30)	Germany	Large	28	4	86	...	90 + 28
	(1841)	8 13 (8 22)	France	> 1	115	87	468	43	266 - 16
46	9 (1866)	3 32 (4 56)	Austria-Hungary	⊖	36	7	29	...	170 + 55
47	9 (1869)	8 26 (9 7)	Germany	Large meteor	128	28	119	27	250 + 35
48	11 (1867)	8 8 (8 11)	France	Almost ⊖	71	41	93	...	86 + 44
49	14 (1877)	8 43 (8 52)	Germany	Splendid	140	27	134	34	215 + 14

See Petit's accounts in *Wochenschrift*, 1858.... June 9, 6<sup>h</sup> 30<sup>m</sup> A.M. in full  
sunshine. Detonating.See Petit's account in *Comptes Rendus*, T. xiv.  
and vi. Detonating.The *Knyahinya Meteorite*.  
Detonating.See Heis's account in *Wochenschrift*, 1869.See Gruey's investigation in  
*Comptes Rendus*, T. lxxxv.  
Detonating.

Ref. No.	Date of Appearance.	Time, G.M.T. (Local Time)	Locality.	Apparent Size or Magnitude.	Height. When First Seen.	Length of Path (Geo- centric).	Real Velocity to the Earth (Geo- centric).	Radiant Point $\alpha$ $\delta$	Number of Observations Used.	Remarks, References, &c.
50	17 (1868)	8 18 (9 23)	Austria	4 C	...	32	...	109 +37	3	A rough determination.
51	17 (1873)	7 38 (8 45)	Austria-Hungary	$\frac{1}{2}$ C	92	20	281	28 $24^{\circ}8'6'' - 20^{\circ}2'$	25	Detonating.
52	17 (1885)	8 47 (10 0)	Bosnia	C	57	30	130	30 $11^{\circ}2' + 42'$	6	
53	19 (1887)	9 23 (10 25)	Austria	Bright meteor	122	21	360	...	282 -19	4
54	July 7 (1892)	8 2 (9 0)	South Europe	$\frac{1}{6}$ C	46	98	836	54 349 + 8	21	True course upwards.
55	8 (1856)	11 38 (6 0)	United States	Large meteor	34	7	37	...	157 +15	4
56	8 (1876)	14 31 (8 45)	United States	Large	88	34	150	...	305 + 6	...
57	13 (1879)	7 30 (8 27)	Austria	$\frac{1}{3}$ C	60	19	119	25 246 -19	10	Detonating.
58	16 (1871)	6 45 (7 34)	Germany	$10 \times \varphi$	23	22	48	...	294 -15	2
59	17 (1876)	7 28 (8 33)	Austria	?	102	49	55	18 260 + 45	3	See Heis's accounts in <i>Wochenschr., 1871.</i> Detonating.

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Ref. No.	Date of Appearance.	Time, G.M.T. (Local Time).	Locality.	Apparent Size or Magnitude.	Height, When First Seen.	Length to the Earth (Geo- centric).	Radiant Point.	Number of Observations Used.	Remarks, References, &c.
60	20 (1860)	14 43 (9 35)	United States	Large meteor	126 at least	42 1000	125 159 + 19 °	6	See Lyman's account in <i>Amer. Journ.</i> , Vol. xxx.
61	22 (1888)	7 3 (7 55)	Adria	Bright	...	21	... 227 + 21 °	4	Observations incomplete, de- terminations only rough.
62	26 (1873)	9 18 (10 23)	Austria-Hungary	♀	50	46	... 250 - 29 °	2	(by Me- teoscopes)
63	30 (1873)	8 31 (9 12)	Germany	> ♀	82	35	184 41 317 - 11 °	2	See Heis's accounts in <i>Wochenschr.</i> , 1873.
64	30 (1879)	9 51 (10 42)	Denmark	♀	107	46	83 ... 330 + 22.5	2	See Kohl's accounts in Klein's <i>Wochenschrift</i> , 1879.
65	Aug. 2 (1860)	15 41 (10 5)	United States	Brilliant meteor	109	28	370 32.5 317 - 23 °	8	See Prof. Newton's accounts in <i>Amer. Journ.</i> , Ser. II. Vol. xxxiii. Detonating.
66	4 (1858)	9 9 (9 40)	Germany	1 1/2	78	70	14 268 + 51 °	4	See accounts in Heis's <i>Wochenschr.</i> , 1858 and 1863. Detonating.
67	6 (1864)	10 20 (10 51)	Germany	> ♀	106	36	142 38 305 -- 8 °	5	See Heis's accounts in <i>Wochenschr.</i> , 1867.
68	7 (1859)	7 59 (8 30)	Germany	Large meteor	138	27	110 24 264 + 53 °	2	See Heis's accounts in <i>Wochenschr.</i> , I.ii. Detonating.
69	10 (1858)	8 32 (9 3)	Germany	2 1/2	128	50	92 23 215 + 55 °	3	See Heis's accounts in <i>Astr. Nachr.</i> 1186.

Ref. No.	Date of Appearance.	Time, G.M.T. and Local Time).	Locality.	Apparent Size or Magnitude.	Height. When First Seen.	Length of Observed Path, Seen.	Radiant Point.	Number of Observations Used.	Remarks, References, &c.
70	10 (1863)	8 <sup>h</sup> 55 <sup>m</sup> (9 45)	Italy	♀	73 18	...	30 + 70 <sup>°</sup>	2	Not a Perseid.
71	12 (1880)	10 44 (11 34)	Norway and Denmark	♀	79 37	166 17	257.5 - 3	3	See Kohl's investigations in Klein's <i>Wochenschr.</i> , 1880.
72	17 (1859)	8 17 (8 53)	Germany	‡ C	83 21	119 43	335 + 17.0	5	See Heis's accounts in <i>Wo- chenschr.</i> T. iii. Detonating.
73	19 (1847)	9 14 (9 23)	France	2 × 4	108 22	266 23	253 - 16.5	2	See Petit's accounts in <i>Comptes Rendus.</i> T. xxv. and T. xxix.
74	19 (1867)	8 37 (9 18)	Germany	3 × 4	158 27	133 30	279 + 43	3	See Heis's accounts in <i>Wochenschr.</i> , 1867.
75	25 (1884)	8 23 (9 25)	Austria	Very splendid	45 32	69	10 + 5.5	2	
76	26 (1858)	18 (45)	Germany	C	44 41	64 41	11 ± 0	2	See Heis's accounts in <i>Wo- chenschr.</i> T. ii. Rad. not accurate.
77	Sept. 5 (1868)	8 <sup>h</sup> 0 <sup>m</sup> (8 0)	Serbia to France	> 24	483 115	1770 41	13.9 - 2.0	12	One of the longest paths.
78	6 (1866)	6 50 (7 55)	Austria	C	37 32	73	79 + 44	2	
79	8 (1869)	6 17 (7 22)	Austria, Italy	4 × 4	115 46	734 73	70 + 45 Many, but rough		

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Ref. No.	Date of Appearance.	Time, G.M.T. and (Local Time).	Locality.	Apparent Size or Magnitude.	Height. When First Seen.	When Last Seen.	Length of Path. (Geo- centric).	Radiant Point	Real Velocity	Number of Observations Used.	Remarks, References, &c.
80	19 (1873)	h m (9 10)	Germany	C	69	23	106	21	208 + 5°	2	See accounts in Heis's <i>Wochenschr.</i> , 1873.
81	27 (1870)	5 27 (6 8)	Germany, Denmark	Large meteor	184	10	450	44	150 + 30	18	See a discussion of Dr. Matthiesen's account in A.N., 1845 and 1846.
82	Oct. 12 (1856)	5 5 (6 0)	Austria	Splendid meteor	73	18	110	...	224 + 25	3	
83	13 (1879)	5 0 (5 51)	Italy	2 x 4	138	20	220	13	304.5 - 11	5	
84	23 (1805)	6 22 (6 58)	Germany	2 x ♀	55	37	101	29	52 + 16.5	3	See accounts in Gilbert's <i>Annalen.</i> T. xxiii.
85	23 (1887)	3 19 (4 20)	Austria	C	136	20	322	30	224 - 8	10	Detonating.
86	23 (1889)	4 17 (5 29)	Austria-Hungary	4 C	105	23	168	14	311.4 - 11.3	9	
87	29 (1857)	5 57 (6 6)	France	Large meteor	83	37	179	23	231 + 6	2	See Petit's accounts in <i>Acta Astr. Nach.</i> , 1180.
88	Nov. 1 (1857)	5 55 (6 26)	Germany	$\frac{1}{3}$ C	157	13	161	...	294 + 42	2	
89	11 (1864)	5 35 (6 8)	France, Germany	$\frac{1}{2}$ C	106	30	446	68	55 + 21	6	See accounts in Heis's <i>Wochenschr.</i> , 1864.
90	11 (1879)	4 44 (5 34)	Austria	Splendid meteor	50	46	11	...	271 - 11	3	

Ref. No.	Date of Appearance.	Time, G.M.T. (Local Time).	Locality.	Apparent Size or Magnitude.	Height. When First Seen.	Length to the Earth Last Observed (Geo- Path. centric).	Radiant Point.	Velocity $a$ $\delta$	Number of Observations Used.	Remarks, References, &c.
91	13 (1873)	7 48 (8 30)	Germany	$\frac{1}{3}$ C	57	18	64	22 $\circ$ 84 + 51	2	See Heis's accounts in <i>Wochenschr.</i> , 1873.
92	Dec. 4 (1885)	6 32 (7 34)	Austria	Brilliant meteor	48	34	110	18	301.4 - 12.8	2
93	7 (1865)	7 40 (7 30)	France	< $\odot$	64	45	92	9 296 + 11	4	See Gruey's accounts in <i>Comptes Rendus</i> . T. lxxii. Detonating. See Heis's account in <i>Wochenschr.</i> , 1868.
94	7 (1868)	3 30 (4 8)	Germany	4	56	41	165	14 43 + 4	3	
95	13 (1888)	5 54 (6 52)	Austria, Germany	♀	85	19	136	27	78 + 22	6
96	17 (1857)	4 18 (4 54)	Germany	Large meteor	48	18	207	34 293 - 20	4	See accounts in Heis's <i>Wochenschr.</i> , 1858.
97	21 (1887)	3 51 (5 0)	Austro- Hungary	C	55	29	68	19 273 + 19.5	5	
98	24 (1850)	6 18 (6 27)	France	Large meteor	50	24	27	5 0 + 50.7	2	See Petit's account in <i>Comptes Rendus</i> . T. xiii. Detonating.
99	24 (1873)	12 47 (7 39)	United States	C	87	9	230	34 109 + 26	20	See account by Cleveland Abbe, Washington <i>Phil. Society's Transact.</i> , 1874. Detonating.
100	31 (1888)	7 40 (8 8)	France, Germany	♀	74	46	336	... 235 + 42	3	See account in Klein's <i>Wochenschr.</i> , 1889.

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## Radcliffe Observations of Comet.

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## Observations of Comet, 1896, I. (Perseine-Lamp), at the Radcliffe Observatory, Oxford.

(Communicated by E. J. Stone, Esq., M.A., F.R.S., Radcliffe Observer.)

The following comet observations (with the exception of March 4) were made with the 10-inch Barclay Equatorial, using the ring micrometer, with power 100. The observation on March 4 was made with the Heliometer, using the ring micrometer, with power 100.

Date.	G.M.T.	Local Sidereal Time.	Comet minus Star R.A.	No. of N.P.D.	Apparent R.A. Parallax in R.A. ( $p \times \Delta$ ).	Log. of Parallax $(q \times \Delta)$ .	Apparent N.P.D. Parallax in N.P.D. ( $q$ ).	Log. of Parallax $(q)$ .	Ref.	
1896.										
Feb. 23	16 46 12	14 55 28	R.	-1 13°41'	-8 33"	5	21 22 25°31'	-1°11	9°6340	57° 2' 23.3
23	16 49 58	14 59 14	R.	-1 49°20'	-8 55°6	3	21 22 29°39'	-1°11	9°6348	57 21 39°4
23	17 53 31	16 2 57	R.	-2 18°60'	-6 9°0	2	21 23 30°33'	-1°11	9°6321	57 9 36°4
Mar.	3 9 19 19	8 2 50	R.	+1 11°40'	+1 21°3	8	1 6 0°30'	+1°07	9°7572	38 14 58°2
4	8 26 21	7 13 40	R.	+1 23°49'	-0 47°2	8	1 24 57 31	+1°05	9°7702	38 14 34°4
14	9 31 33	8 58 29	R.	-1 49°11'	+6 8°1	9	3 14 33°50'	+0°59	9°7334	42 16 48°2
16	10 4 39	9 39 33	R.	-1 15°09'	+2 25°5	8	3 25 42°52'	+0°54	9°7270	43 6 39°0
19	8 5 44	7 57 11	W.	+1 25°57'	...	10	3 38 49°13'	+0°43	9°6756	...
19	8 5 44	7 57 11	W.	+1 20°70'	-5 58°8	10	3 38 48°71'	+0°43	9°6756	44 11 9
Apr. 9	9 58 36	11 8 6	R.	-3 34°04'	-0 54°1	8	4 29 30°09'	+0°26	9°6798	48 48 10°3
10	9 19 31	10 32 51	R.	-0 51°33'	-1 26°9	6	4 31 1°07'	+0°26	9°6851	48 55 49°8

## Observers' Remarks.

(a), (b), (c) Coma is 2' in diameter. Nucleus diffused, mag. 9 or 10. The comet is visible in the 3-inch finder.

(c) Very faint, strong twilight.

(d) The comet's coma is, approximately, 3' in diameter. The nucleus (a large nebulous image, say 15") is brighter than on February 23.

(e) Condensation bright, but more nebulous than with Barclay last night.

(f) Coma of comet 2' diameter; condensation seemed stellar at times, mag. 10. The comparison star is reddish. Sky hazy.

(g) Coma 2' in diameter, with a nebulous condensation. Nucleus visible at times, mag. 11. Sky hazy at intervals.

(h), (i) The comet is a round diffused mass, with a stellar brightening showing occasionally as a nucleus of about the 13th magnitude. A very small star was close to the comet's nucleus at about 8° 10° G.M.T. Moon near, but sky clear. Observing almost impracticable at times, noises.

(j) There is no nucleus, but a slight condensation shows up at times. Diameter of coma 1'.

(k) Observations rather difficult. Coma large, but feeble. A star, magnitude 12 or 13, follows within the condensation, which is only faintly visible. Wind slightly gusty, causing occasional small vibrations of the telescope.

Observers: W. Mr. W. Wickham ; R., Mr. W. H. Robinson.